

## **SECTION 16460**

### **TRANSFORMERS**

#### **PART 1 - GENERAL**

##### **0.1 DESCRIPTION**

- A. Work Included: This Section specifies furnishing and installing lighting and secondary power distribution transformers.

##### **0.2 SUBMITTALS**

- A. Prior to purchase, submit for approval certified manufacturer's test data for each type and rating of transformer from each manufacturer, of the following tests conducted within the past two years:
  1. Applicable ANSI/IEEE Std. 462 routine and optional tests.
  2. Noise Level Tests
- B. Performance and Test Data. Submit guaranteed performance data consisting of losses, no load and full load, percent impedance, percent regulation at 1.0 and 0.8 power factor, and the average and maximum sound level in db; and all test data. Data must be corrected to the appropriate NEMA reference temperatures.
- C. Shop Drawings. Include physical drawings or catalog cuts showing all dimensions, weight, wiring diagrams or catalog cuts showing primary and secondary connections, taps, ratings and characteristics, anchor bolt plan or mounting brackets or platforms furnished separate from the transformer, and grounding requirements.
- D. Submit evidence of UL listing or label.

##### **0.3 QUALITY ASSURANCE**

- A. Perform the following shop tests at the transformer manufacturer's plant:
  1. Prior to Purchase: As specified in Part 1 "Submittals" Article.
  2. Prior to Delivery: All applicable routine tests specified in ANSI/IEEE Std. 62 and all applicable optional tests on one of each type and rating by the same manufacturer; ANSI/UL 506 and ANSI/NEMA Pub. No. ST 1 requirements as applicable; noise level test on each transformer.

## PART 2 - PRODUCTS

### 0.1 GENERAL REQUIREMENTS

- A. Flux Density: Sufficiently below saturation to allow a minimum of 10 percent over-voltage excitation.
- B. Noise Level: Not exceeding limits set by cited standards or local regulations, and not exceeding the following:

Equipment Rating, kva	Average Sound Level, db
0-9	40
10-50	45
51-150	50
151-300	55
above 300	58

- C. Finishes: Thoroughly cleaned, degreased, coated with hot phosphate chemical bath, corrosion inhibiting primer or undercoat, and overall finish coat of manufacturer's standard electrical grey pigmented paint, as approved.

### 0.2 SPECIAL TRANSFORMERS

- A. Constant Current (Series) Supply Type: ANSI C82.8.
- B. Single-Phase Underground Type: ANSI/IEEE Std. 462 and ANSI C57.12.23, primary voltage as indicated, 240/120 volt secondary, 100 kva and smaller.
- C. Overhead-Type Distribution Transformers: Liquid immersed type, ANSI C57.12.20 and as indicated.
- D. Rectifying Type Outdoor Application: Oil immersed, self-cooled (Class OA), ANSI C57.12.10.
- E. Other Specialty Transformers: ANSI/UL 506 and ANSI/NEMA Pub. No. ST 1, UL labeled or listed.

### 0.3 GENERAL PURPOSE TRANSFORMERS

- A. General Requirements

1. All applicable ANSI/IEEE Std. 462 and UL requirements; and NEMA TR 1, TR 11, or ST 1-4 requirements, as applicable. Indoor dry type, primary and secondary copper windings, self-cooled, with class H insulation at 40 degree C ambient temperature, but with winding rise limited to 115 degrees C.
2. Transformer coils: Vacuum impregnated with non-hygroscopic, thermosetting varnish, final wrap of electric insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnet wire visible will not be acceptable.
3. The core and coil: Completely isolated from the enclosure by means of vibration absorbing mounts with no metal-to-metal contact between the core and coil and the enclosure. On units 500 KVA and smaller, the vibration isolating system shall be designed to provide continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie-down facilities will not be acceptable.
4. All ventilating openings: Louvered type; expanded metal coverings will not be accepted. The base of the transformers shall be constructed of twelve gauge steel minimum with stamped openings for ventilation.
5. Provide lifting eyes or provisions on transformer enclosures, holes in the enclosures requiring the use of spreader bars will not be acceptable.
6. Core and coils: Visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.

B. Ratings

1. Voltage: Primary, 480 unless otherwise indicated. Secondary, single phase, 240/120; three phase, 208Y/120.
2. KVA Rating: Single or three-phase as indicated, 60 hz.
3. Class: AA
4. Rise Rating: 15 kva and above, 150 degrees C; below 15 kva, 80 degrees C.
5. Enclosure: Totally enclosed; non-ventilating through 15 kva, 3-phase and 25 kva, single-phase; non-ventilated or ventilated or ventilated dripproof at higher kva ratings.
6. Mounting: 45 kva and below, wall mounting type unless otherwise indicated; above 45 kva, floor or platform mounting type.
7. Taps
  - a. Single phase, less than 15 kva, two 5 percent taps below rated voltage; 15 kva and above, six 2-1/2 percent increment taps on primary, two above and four below rated voltage.
  - b. Three phase, below 30 kva, four 2-1/2 percent increment taps on primary, two above and two below rated voltage on primary; 30 kva and above, two above and four below rated voltage.
8. Busses: Tinned copper.

## **0.4 MINIATURE UNIT POWER CENTERS**

- A. Type: Common enclosure mounted primary breaker, transformer, and secondary distribution breaker panel, UL labeled.
- B. Limitations: 480 volt supply to 120/240 volt or 208y/ 120 volt distribution, 3 to 30 kva, not more than 24 secondary circuits.
- C. Primary Circuit Breaker: ANSI/IEEE Std. 20, 480 volt rating; UL listed.
- D. Secondary Circuit Breakers: UL labeled molded case plug-in type.
- E. Transformers
  - 1. Dry type, ANSI/NEMA Pub. No. ST 1, single phase, 60 hz, 480 to 120/240 volt, 50 db maximum noise level, UL labeled or listed.
  - 2. Single phase transformers through 10 kva will require two 5 percent taps below rated voltage; single phase transformers 15 kva through 25 kva shall have six 2-1/2 percent increment taps on primary, two above and four below rated voltage; three phase transformers 6 kva through 15 kva shall have two 5 percent full capacity taps below normal rated primary voltage; all transformers 30 kva and larger shall have six 2-1/2 percent increment taps on primary, two above and four below rated voltage.
  - 3. Transformers with the ratings through 25 kva shall have either class B insulation and be designed so that under full load the average conductor temperature does not exceed 80 degrees C rise, or class H insulation and be designed so that under full load the average conductor temperature does not exceed 115 degrees C rise. Transformers with ratings 30 kva or larger shall be constructed with class H insulation and so designed that under full load the average conductor temperature does not exceed 115 degrees C rise.
- F. Enclosure and Distribution Panel: Indoor/outdoor integral non-ventilated type, hinged door with lock, neutral bar, lugs for all conductor connections suitable for both copper and aluminum conductors, with circuit identification directory, meeting requirements for panelboards specified in Section 16471 - DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS.
- G. Factory Wiring: The primary circuit breaker, transformer, and distribution panel with secondary circuit breakers shall be factory mounted and all interconnecting wiring between the primary breaker and the transformer, and between the transformer and the secondary distribution system, shall be factory installed and inspected before shipment.

## **0.5 REACTORS**

- A. Current Limiting: ANSI C57.16.
- B. Shunt: ANSI C57.21.

## **PART 3 - EXECUTION**

### **0.1 GENERAL**

- A. Install transformers as indicated and in accordance with manufacturer's instructions.
- B. Conduit Connections. Use flexible metal conduit not less than 18 inches or more than 36 inches in length unless otherwise indicated.
- C. Comply with NFPA 70, Article 450 and ANSI C2, Section 15.
- D. Comply with manufacturer's instructions and ANSI C57.94. Mount 5 kva and larger transformers on vibration damping and noise reducing supports or devices to further reduce the noise level below that above specified.
- E. Install unit power centers as specified for panelboards, Section 16471 - DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS.
- F. Grounding: Section 16450 - GROUNDING.
- G. Wiring and Miscellaneous Electrical Work: Section 16050 - BASIC MATERIALS AND METHODS FOR ELECTRICAL WORK. Bring primary service to transformer as necessary. Take secondary service to panelboards or other equipment. Wire transformers and related equipment as indicated and in accordance with mini power centers as specified for panelboards, Section 16471 - DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS.
- H. Apply approved touch-up paint as necessary.

### **0.2 ENERGIZING AND TESTING**

- A. Verify that circuits are connected as indicated.
- B. Perform insulation and circuit continuity tests prior to connecting primary service.
- C. Test all circuit breakers, switches and miniature unit power centers as specified for panelboards, Section 16471 - DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS.

### **0.3 DIELECTRIC TESTS**

- A. Ensure that the resistance of transformer and equipment enclosures to ground is not over two ohms.

## **PART 4 - MEASUREMENT AND PAYMENT**

### **0.1 MEASUREMENT**

- A. Transformers will be measured as per each complete in place, including all preparation, accessories and incidentals.

### **0.2 PAYMENT**

- A. Payment for transformers will be made at the Contract unit price for the quantities as specified above.

### **0.3 PAYMENT ITEMS**

ITEM NO.	DESCRIPTION	UNIT
1620.025	TRANSFORMERS	EA

**END OF SECTION**